Data Gaps, Conceptual Remedial Design/Remedial Action Workplan at Sites SD-10 and LF-13

Final Conceptual Design Work Plan for Site 10 Remedial Action

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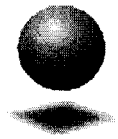

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SECTION 1.0

Introduction

This Conceptual Design Work Plan (CDWP) presents the conceptual-level remedial design for the remedial actions selected for Site SD-10 (Site 10), Beale Air Force Base (AFB or Base) as documented in the *Draft Final Record of Decision (ROD) for Sites 10 and 13* (CH2M HILL, 2004). The selected remedial actions include soil and groundwater remedial actions and land use controls (LUC).

This CDWP was developed under the Air Force Center for Environmental Excellence (AFCEE), Contract No. F41642-03-D-8595, Task Order No. 0066 (BAEY 2003-7010 [Site SD-10]) for Beale AFB, California (see Figure 1-1). (All figures are located at the end of each section.) Beale AFB reviewed and made no comments regarding the draft version of this CDWP submitted in April 2004. This final version of the CDWP has been prepared in accordance with AFCEE requirements.

1.1 Purpose and Scope

This CDWP presents a conceptual-level design for the selected remedy for Site 10. A Remedial Action Work Plan that will provide additional detail for the implementation for the Site 10 remedial action will follow. The project schedule presented in Section 6.0 shows the proposed sequence of documents and construction.

This CDWP presents results of hydrogeologic monitoring and groundwater-flow modeling and provides a conceptual design for the following:

- Excavation of polycyclic aromatic hydrocarbon (PAH)-contaminated soil
- Conversion of the existing soil vapor extraction (SVE) system to a biovent system
- Monitored natural attenuation (MNA) of the distal portion of the groundwater plume
- Enhanced in situ bioremediation (EISB) of the groundwater source zone
- LUCs

This CDWP also contains a Treatability Study Report (Appendix A) that summarizes the results of bench testing for EISB evaluation and a pilot test conducted at Site 10.

1.2 Report Organization

This CDWP is divided into the following sections:

- **Section 1.0 – Introduction.** Presents the purpose, scope, and history of Site 10 and the remedy selected in the ROD.
- **Section 2.0 – Soil Remediation.** Presents the conceptual design for the SVE conversion to biovent and excavation of PAH-contaminated soil.

- **Section 3.0 – Monitored Natural Attenuation.** Presents the conceptual design for MNA of the distal end of the groundwater plume.
- **Section 4.0 – Enhanced In situ Bioremediation.** Presents the conceptual design for the bioremediation system that will treat the groundwater source area.
- **Section 5.0 – Regulatory Permitting Requirements.** Identifies the permitting issues involved with the remedial action identified in this CDWP.
- **Section 6.0 – Project Schedule.** Presents a preliminary schedule of major tasks required to complete the remedial action.
- **Section 7.0 – Works Cited.** Lists reference material used in preparation of this CDWP.

This CDWP includes the following appendices:

- **Appendix A** – Treatability Study Report
- **Appendix B** – Groundwater Modeling
- **Appendix C** – Construction Quality Assurance/Quality Control Plan
- **Appendix D** – Results of Hydrogeologic Monitoring
- **Appendix E** – Design Specifications
- **Appendix F** – Photo Documentation
- **Appendix G** – Equipment and Systems Warranty Report
- **Appendix H** – Cost Estimate

1.3 Site Background

1.3.1 Site History

Site 10 is located in the north-central portion of Beale AFB, east of Doolittle Drive and the flightline area. Site 10 is more than a mile from the nearest Base boundary and more than 2 miles from the nearest drinking water well. The most significant feature of Site 10 is a building that was formerly used as a test cell for SR-71 aircraft engines. A portion of the site consists of a paved area at the eastern end of Grumman Avenue, with the former engine test cell located in the center of the paved area and an office building and latrine located on the south side of the paved area. Aboveground storage tanks, used to store fuel for the engine tests, were once located just to the northwest of the test cell (see Figure 1-2).

Fuel that was spilled or discharged during the process of engine testing flowed across the concrete pad and eventually washed onto the surrounding ground surface. Most of the fluid eventually discharged to the drainage area southeast of the test cell, impacting nearby soils and groundwater. Soil discoloration and petroleum odor have been observed in the drainage ditch near the test cell. Contaminants include jet fuel, petroleum distillates, soap, oil, and solvents (CH2M HILL, 2003a).

1.3.2 Site 10 Extent of Contamination

1.3.2.1 Groundwater

At Site 10, trichloroethylene (TCE) is the most widespread contaminant in groundwater. As shown on Figure 1-3, the groundwater TCE contaminant plume (5 micrograms per liter [µg/L] or greater) in the upper groundwater zone at Site 10 covers about 42 acres. Concentrations of TCE near the test cell, which is the source area, are much higher than in the distal portion of the plume where natural processes such as dilution have reduced contaminant concentrations. The maximum concentration of TCE measured in groundwater beneath Site 10 was 3,000 µg/L (measured in 10C022IW). Approximately 12 acres at Site 10 have TCE concentrations greater than 100 µg/L and are considered the source area.

Other contaminants that were identified as contaminants of concern (COC) in groundwater in the *Final Site 10 Feasibility Study* (CH2M HILL, 2003b) include the following:

- Benzene
- Chloroform
- cis-1,2-Dichloroethene (DCE)
- Methyl tert-butyl ether (MTBE)
- Tetrachoroethylene (PCE)
- Total petroleum hydrocarbons as diesel (TPH-D)
- trans-1,2-DCE

None of these compounds exist outside the area bounded by TCE concentrations greater than 5 µg/L.

Groundwater flow is generally toward the southwest in both the upper and lower groundwater zones. The gradients in the upper groundwater zone are generally steeper than in the lower zone; however, these steeper gradients may not result in faster groundwater flow because of the lower permeability of the sediments in the upper zone.

1.3.2.2 Soil and Soil Vapor

The area of impacted soil at Site 10 is limited to the test cell area and immediately adjacent land. TPH-D contamination exists in the vadose zone to depths of up to 35 feet below ground surface (bgs) and is commingled with volatile organic compound (VOC) contamination. VOCs have been detected throughout the vadose zone down to groundwater, which is at approximately 35 to 40 feet bgs. Beale AFB has already implemented remedial measures to remove VOCs and TPH-D from soil at Site 10.

On the basis of conservative engineering estimates, it is believed that TPH-D contamination could impact approximately 100 cubic yards of soil. Most of the VOCs in soil have already been removed through operation of the Site 10 SVE systems. PAHs were found to be a concern in a small drainage area in the top 6 inches of soil. This PAH-contaminated soil exists north of the test cell and includes about 13 cubic yards of soil.

VOC concentrations in extracted soil vapor from Site 10 have been low and relatively constant since second quarter 2001, and mass extraction rates appear to have reached a low-level asymptotic condition. Following an 8-week rebound period, rebound sampling was conducted in November 2002, at VMP-1 through VMP-4, VE-3, VE-4, and VE-5; and no

VOCs were detected at concentrations above the cleanup levels shown in Table 1-1 in Section 1.6.2.

1.4 Site 10 Current and Potential Future Land and Resource Use

The Beale AFB General Plan designates existing and planned future land use for Beale AFB. Much of the land in the vicinity of Site 10 is open pasture; however, the land is not used for grazing or recreational purposes.

Currently, the land at Site 10 is zoned for aircraft operation and maintenance (O&M) use and is used as a collection area for recyclable and hazardous materials generated onbase. Because Site 10 is located within the interior of the Base near the flightline, access to the site is restricted to onsite military personnel. Moreover, the interior Base location of Site 10 minimizes the potential for the contaminants present at Site 10 to have any impact on offbase land uses. Because of the proximity of Site 10 to the flightline and access restrictions, open space located within the boundaries of the Site 10 Investigation Area would unlikely be used for recreational purposes. Land use at Site 10 is not anticipated to change in the future.

1.5 Summary of Selected Remedy

The remedy at Site 10, selected in the ROD, includes five discrete components. Each of the remedy components is described in more detail below.

1.5.1 Excavation of PAH Soils

Beale AFB will complete a remedial action at Site 10 to remove PAH-contaminated surface soils in the drainage ditch north of the test cell. The remedial action reduces human health risk to less than an estimated lifetime cancer risk (ELCR) of 10^{-6} for residential use of the site.

According to estimates contained in the *Final Site 10 Feasibility Study* (CH2M HILL, 2003b), the area subject to this removal action includes 140 feet of the West Drainage Area north of the test cell (see Figure 2-1). The impacted area is estimated to include surface soils within 2.5 feet of the centerline of the drainageway and to approximately 6 inches deep. The impacted area includes approximately 13 cubic yards of soil.

Upon completion of the remedial action, confirmation soil samples will be collected to confirm that the goals of the removal action are met. According to the results of the confirmation soil sampling, additional soil removal could be warranted if PAH concentrations remain above residential human health risk criteria.

All soil removed from Site 10 is anticipated to be disposed of at an offbase disposal facility in accordance with state and federal disposal requirements.

1.5.2 Bioventing

The bioventing component of the Site 10 remedy targets soil that contains TPH-D. This remedy component will make use of the existing SVE system as a biovent system. The SVE

system that is currently in use for extraction of VOCs in the vadose-zone soils can be reconfigured into a biovent system to target biological degradation of petroleum hydrocarbons. The reconfiguration of the SVE system would be conducted following completion of VOC extraction using the SVE system. Bioventing will enhance degradation of less volatile, less soluble hydrocarbons that remain after SVE.

1.5.3 Monitored Natural Attenuation

Groundwater with TCE concentrations less than approximately 100 µg/L will be remediated through MNA. A modified monitoring program will be implemented to include additional monitoring parameters. These data will be used to evaluate the effectiveness of MNA at the distal end of the plume at Site 10. Additional monitoring wells will be installed to facilitate the monitoring needed for MNA.

1.5.4 Enhanced In situ Bioremediation

The enhanced bioremediation groundwater remedy component accelerates bioremediation of chlorinated VOCs via biostimulation using an electron donor (soluble carbon source) to promote reductive dechlorination within the approximate 12-acre area where TCE concentrations in groundwater exceed approximately 100 µg/L (Figure 1-3). The enhanced bioremediation system would extract groundwater, mix it with an electron donor, and reinject it to stimulate enhanced biological reductive dechlorination of chlorinated VOCs. The aquifer would also be innoculated with specially isolated bacteria that are adapted to degrading TCE directly to ethene under anaerobic conditions. The *Final Site 10 Feasibility Study* (CH2M HILL, 2003b) estimates suggest that 13 injection points and 9 extraction wells could distribute an electron donor across the 12-acre source zone. If a passive injection system is used at Site 10, as opposed to a recirculating system, the number of required wells is likely to increase to provide adequate electron donor distribution over the 100-µg/L VOC plume.

1.5.5 Land Use Controls

Upon completion of the remedial action for PAH-contaminated soils, the human health risk at Site 10 resulting from contaminated soils will be reduced to less than an ELCR of 10^{-6} for residential use. Beale AFB will perform the Site 10 removal action no later than 90 days after approval of the Remedial Design. Accordingly, LUCs associated with potential soil exposure are not required for Site 10. LUCs associated with Site 10 to protect human health and the environment are limited to groundwater access and groundwater use restrictions. The LUC objective for Site 10 is as follows:

- Ensure no withdrawal or use of groundwater that would result in human or ecological exposures to contaminants or would adversely affect implementation of the selected remedy. No drinking water wells will be allowed at Site 10 without prior approval from the U.S. Air Force (Air Force) and appropriate regulatory agencies.

Currently, Beale AFB and the Yuba County Department of Environmental Health controls groundwater access and use within the Site 10 Investigation Area. Both Beale AFB and Yuba County have existing permitting programs to control the installation of monitoring wells and water supply wells. The Base Civil Engineer must approve any ground disturbance within Beale AFB through the issuance of a digging permit (Air Force Form 103). Yuba

County Department of Environmental Health must approve installation of supply wells through issuance of a well permit. These two permitting programs shall be the primary mechanisms by which to restrict access and use of impacted groundwater that contains contaminants at concentrations above the cleanup levels (see Table 1-2 in Section 1.6.3).

A Land Use Controls Implementation Plan (LUCIP) will be developed for Site 10 in conjunction with the remedial action. The Base General Plan will include a reference to the LUCIP and the land use control requirements for Site 10 contained therein. At a minimum, the LUCIP shall contain the following information:

- A brief description of the site including historical use, COCs, general location, and the size of the site in acres
- The objectives of the LUCs to be implemented
- A survey plot that delineates the site investigation boundary and the extent of groundwater contamination that is above the cleanup levels (Table 1-2 in Section 1.6.3)
- A description of the activities and uses that are either prohibited, restricted, or otherwise controlled by the LUCIP
- A description of any existing controls or physical structures that will be maintained for purposes of achieving the LUC objectives
- The processes that will be used to implement the LUCs (e.g., Base General Plan, Yuba County permitting process, and LUCIP), including how the specific restrictions associated with the LUC will be enforced
- Identification of parties responsible for enforcement of the LUC and their roles and responsibilities associated with such enforcement
- A description of how the LUCs will be incorporated into any real property documents necessary for transferring ownership of the property from the United States, in the unlikely event that the United States sells or transfers the property
- A schedule for implementing the key elements of the LUCIP
- A schedule and description of inspection and reporting necessary to maintain the LUC
- The criteria and process to revoke or modify any LUC

1.6 Chemical- and Media-specific Cleanup Levels

To demonstrate the remedy's effectiveness in meeting the remedial action objectives (RAO) described in Section 3.1, numerical cleanup goals have been established for COCs in soil, soil vapor, and groundwater.

1.6.1 Soil Cleanup Levels

COCs in soil include PAHs and TPH-D. PAHs are targeted for remediation to restore the site for potential future residential use. TPH-D is targeted for remediation because of its potential to have an adverse impact on groundwater quality.

1.6.1.1 PAHs

The results of confirmation soil sampling will be used to recalculate the site risk to determine the residual risk after implementation of the remedial action. Cleanup goals will be met if the confirmation soil sample concentrations of PAHs, combined with the remaining site data used in the initial Human Health Risk Assessment, result in an incremental lifetime cancer risk of less than 1.0×10^{-6} for all residential scenario exposures.

1.6.1.2 TPH-D

Preliminary cleanup levels for TPH-D in Site 10 soil were not adopted in the ROD for the following reasons:

- It is not necessary to achieve those levels to meet the RAOs or comply with applicable, relevant, and appropriate requirements.
- The cleanup levels do not consider human health or ecological risks.
- The cleanup levels do not recognize economic or technical feasibility factors associated with the selected remedy (bioventing).

Moreover, according to the Site 10 risk assessments described earlier in this report, TPH-D contamination does not pose a significant risk to human health or the environment. Nonetheless, to protect groundwater quality to the extent practicable, the Air Force will operate the biovent system described previously until the following objectives are met:

- Contaminant reduction rates have reached asymptotic levels, following appropriate rebound testing
- Oxygen monitoring during periods of shutdown shows that adequate oxygen levels are being maintained in the vadose zone to promote natural biodegradation of TPH-D

1.6.2 Soil Vapor Cleanup Levels

The existing SVE system at Site 10 is operating to mitigate source area VOC contamination in soil and soil vapor. Cleanup goals for this system were previously developed as part of the Long-term Operating and Maintenance (LTO&M) Program for Beale AFB interim removal actions. The LTO&M goals were conservatively calculated to ensure that soil contamination does not contribute to the exceedance of maximum contaminant level (MCL) concentrations in groundwater.

The soil vapor cleanup goals will be achieved at Site 10 through operation of the existing SVE system unless the Air Force and California Environmental Protection Agency (CalEPA) agree that it is technically and economically infeasible to continue operation of the SVE system. The determination of technical and economic feasibility shall be based on an evaluation process agreeable to both parties. The Air Force will continue to monitor the soil vapor concentrations at the site until the cleanup goals are met or it is determined that the residual vadose-zone contamination will not result in exceedance of groundwater cleanup levels. Table 1-1 provides the soil vapor cleanup levels.

TABLE 1-1
Site 10 Cleanup Goals for Soil Vapor COCs
Conceptual Design Work Plan for Site 10 Remedial Action, Beale Air Force Base, California

	Contaminant Properties		Groundwater Criteria		Soil Vapor
Analyte	Henry's Law Constant[a] (dimensionless)	Gas Density (µg/µL)	Federal MCL (µg/L)	California MCL (µg/L)	Cleanup Level (ppbv)
TCE	0.38	5.45	5	5	**350**
cis-1,2-DCE	0.31	4.04	70	6	**450**

[a]Source: *VLEACH, A One-Dimensional Finite Difference Vadose Zone Leaching Model, Version 2.2* (U.S. Environmental Protection Agency [EPA], 1997c).

Notes:
µg/µL = micrograms per microliter
ppbv = parts per billion by volume

1.6.3 Groundwater Cleanup Levels

The groundwater cleanup levels established in the ROD are derived from the State Primary MCLs referenced in the California Code of Regulations, Title 22, Section 64444. The MCLs represent the minimum cleanup level allowed under the Regional Water Quality Control Board's (RWQCB) Water Quality Control Plan for the Sacramento River and San Joaquin River Basins for groundwater with a designated beneficial use of municipal or domestic supply. According to prior negotiations with CalEPA, the Air Force agreed to evaluate the technical and economic feasibility of achieving groundwater cleanup levels lower than the MCLs, after the MCLs have been achieved.

Table 1-2 provides the cleanup levels established in the ROD for groundwater COCs at Site 10.

TABLE 1-2
Cleanup Levels for Groundwater COCs at Site 10
Conceptual Design Work Plan for Site 10 Remedial Action, Beale Air Force Base, California

Contaminant of Concern	MCL (µg/L)
cis-1,2-DCE	6
PCE	5
trans-1,2-DCE	10
TCE	5

1.6.4 Monitoring Points

The cleanup levels described in Section 1.6 will be assessed at various monitoring points throughout Site 10. The specific monitoring points and the frequency of monitoring will be established during the remedial action and implemented through the existing Basewide Groundwater Monitoring Program and/or the LTO&M Program.

The Air Force may use the existing network of monitoring wells and vapor monitoring points at Site 10 to demonstrate the effectiveness of the remedy, provided that they meet the criteria established in the ROD for soil vapor and groundwater monitoring. Additional

monitoring points may be installed, as necessary, to provide additional data needed to optimize the remedy or to provide additional support for site closure when cleanup objectives have been met.

At a minimum, the network of monitoring points will meet the following criteria:

1. A sufficient number of monitoring points installed at appropriate locations and depths to yield groundwater samples from the uppermost aquifer that represent the quality of groundwater passing through a vertical surface located at the hydraulically down-gradient limit of the contaminant plume that extends through the uppermost aquifer underlying the unit
2. A sufficient number of monitoring points at other locations within the contaminant plume in the uppermost aquifer to provide the data needed to evaluate the effectiveness of the remedy and demonstrate compliance with cleanup levels

It is noted that the downgradient limit of the contaminant plume may change over time due to hydrogeologic factors and the influence of the remedy on contaminant concentrations. Accordingly, the network of monitoring points used to track the contaminant plume and evaluate the effectiveness of the remedy may change throughout the remedial action.